1. Name of Experiment/Project/Collaboration

   LBNE 35-Ton Liquid Argon TPC Prototype

2. Physics Goals
   a. Primary

   The 35-ton prototype is an R&D project, so the primary goal is not physics-related. Rather the goal is to develop and evaluate the "LBNE-style" LArTPC design. This design *contains many features that are desirable and/or necessary for the construction of a large (multi-kTon) detector but remain untested. Although the LBNE collaboration no longer exists, this work continues and will inform any future large-scale, single-phase LArTPC Testing of the design will be done by building a reduced-scale prototype LArTPC that incorporates as many of the proposed design innovations as possible, and then taking and analyzing cosmic ray data. The new design elements include: membrane cryostat, modular Anode Plane Arrays (APA) with wrapped wires immersed in the active volume, a printed-circuit style FR4 field cage, cold digital electronics, "light guide" scintillation photon detectors, cold digital electronics (including an ADC ASIC) and a high-speed "triggerless" data acquisition system.*
3. Expected location of the experiment/project:

   Currently under construction at the PC4 area of Fermilab.

4. Neutrino source:

   None. Cosmic muons and other particles will be the sources of tracks and showers.

5. Primary detector technology:

   Single-phase Liquid Argon TPC with design improvements mentioned above. External plastic scintillators will provide track position and event time information to calibrate the TPC and internal photon detectors.

6. Short description of the detector

   The active volume of the TPC is roughly 2m x 2m x 2m and is divided into 8 modules (drift volumes). The multiple modules will allow study of the gaps between modules. Each module has 3 instrumented wire planes and one outer grid plane. The pre-amplifiers and the digitizers are in immersed in the liquid argon – the BNL ASIC pre-amplifier and ADC will be used. The design includes wrapped wire planes to increase the fiducial volume by eliminating the need to place pre-amplifier circuits between modules. The data will be digitized in the cold and transmitted out of the cryostat on high-speed digital lines, thus reducing noise and cable count. A new technology is used for light detection that utilizes light guides coated in wavelength shifter and SiPMs, another necessary change (from the cryo PMTs used in ICARUS and MicroBooNe) for large LArTPCs.

7. List key publications and/or archive entries describing the project/experiment.
   a. *LBNE DocDB 8885-v6*

8. Collaboration
    a. Institution list
    Same as LBNE
    b. Number of present collaborators
    Same as LBNE. Current effort ~10 FTE on software and analysis. Also, significant scientific effort on design and construction.
    c. Number of collaborators needed.
    Will ramp to ~12 FTE for operations and analysis during and immediately after data-taking

9. R&D
    a. List the topics that will be investigated and that have been completed
        i. *APA performance: wrapping ambiguities, gaps, tracks crossing APAs, energy resolution*
        ii. *Photon detector performance: event time resolution, photons/MeV*
        iii. *Electronics/DAQ performance: Signal/Noise with cold pre-amp and ADC, triggerless operation*
        iv. *Cryostat performance: purity, acoustic noise*
        v. *FR4 printed-circuit field cage performance.*
    b. Which of these are crucial to the experiment.
    All of the above are crucial to any future large-scale, single-phase LArTPC.
    c. Time line
    Data-taking April-June 2015. Data analysis completed 2016.
    d. Benefit to future projects
    This will be the first TPC operated inside a membrane cryostat. It is the first to use wrapped wire planes within the active volume, cold digital electronics and wave-guide light detectors together with a TPC. Demonstration of these improvements will inform the design of any large-scale (multi-kTon) LArTPCs, as they will enable lower costs and higher fiducial volume.
10. Primary physics goal expected results/sensitivity:
    a. Synergies with other experiments.
    Knowledge gained from the 35-ton prototype will benefit all future single-phase LArTPCs. Including LAr1ND, WA105 (Single Phase) and LBNE FD
11. Secondary Physics Goal
    a. Expected results/sensitivity
        N/A
    b. List other experiments that have similar physics goals
        N/A
12. Experimental requirements
    a. Provide requirements (neutrino source, intensity, running time, location, space,…) for each physics goal
    Required running time is approximately two months
13. Expected Experiment/Project time line
    a. Design and development
    Completed

b. Construction and Installation
   Ongoing, 9-12 months total duration
c. First data
   April 2015
d. End of data taking
   June 2015
e. Final results
   2016

14. Estimated cost range
    a. US contribution to the experiment/project
       Part of LBNE project
    b. International contribution to the experiment/project
       N/A
    c. Operations cost
       25K$/month
15. The Future
    a. Possible detector upgrades and their motivation.
        i. *Depending on results, additional running with a modified detector may be desirable*.
        ii. *Further development of cryogenic systems and feedthroughs is possible*
    b. Potential avenues this project could open up.
       Some LArTPC design changes may be found that need further development and testing.